SCIENCE.

FRIDAY, JULY 16, 1886.

COMMENT AND CRITICISM.

THE U. S. FISH COMMISSION is now well started in its summer work. Professor Baird and a party of a dozen scientific men and investigators are at Wood's Holl; the Albatross is in northern waters, engaged in dredging for marine life; the Fish Hawk has gone to St. Jeromes, on the Chesapeake; and the Lookout has been engaged for some time in the lower Chesapeake, conducting experiments in hatching crabs and Spanish mackerel. At St. Jeromes the principal work is in oyster-culture. At this season the spawning oysters are secured, and the spawn taken from them artificially by methods devised by Professors Ryder and Brooks. Perhaps the most significant features of the work of the commission this season, however, are the experiments in the propagation of crabs and Spanish mackerel, which bid fair to be as successful as those recently inaugurated at Wood's Holl in the artificial propagation of the lobster. One of the results of these experiments will be the transportation of millions of young crab to the Pacific coast, where, when once firmly established, they will add materially to the food-products of the waters of that section. Scientific experts on the commission state that no crab of the Pacific waters can ever take the place of the blue or edible crab of the Atlantic coast.

THE PASTEUR INSTITUTE in France is more successful in its appeals for financial aid than a similar institute organized for the same purpose in the city of New York. The French people have already contributed more than one million francs towards the perpetuation of the Paris institute, at which more than a thousand persons have been inoculated for the prevention of rabies, while we are informed that the support given to Dr. Mott for a similar purpose is so meagre that his work will probably be discontinued after a few weeks. The American people were willing to subscribe an unlimited amount to send a few children to Paris; but, now that an opportunity is given them to provide protection to the whole population of the United States, they fail to respond.

THE CONTROVERSY over the glacial origin of lake-basins has had a satisfactory termination in at least one case. Heim of Zurich has maintained the inefficiency of glacial erosion, and refused to admit that the Swiss or any other large lakes could have such an origin. Penck, lately of Munich, now in Vienna, has insisted that the Bavarian lakes were cut out by ice, and implied that Lake Zurich and many others were also. Last fall these two professors undertook a joint excursion, going together to the ground formerly examined by each one alone, and they found that their problems are really distinct. Heim now admits that the Bavarian lakes are, after all, most probably glacial excavations in gravel deposits; and Penck sees that dislocation has had an essential share in the formation of Lake Zurich, although ice may have given it the finishing touches. The concluding paragraph of their joint report, as translated in the *Geological magazine* for June, teaches a larger lesson than many controversialists have learned: "There is, therefore, no real difference of opinion between us, touching the Lake of Zurich and the lakes of the Bavarian highlands, either as regards the facts or the conclusions from them; and as in the present case, so also does it often happen, that, by a more exact conjoint examination, differences become of much less importance than they appear to be from a distance."

LADY FLORA WILMOT died at Swansea, Eng., after taking chloroform in a dentist's chair, for the extraction of a tooth. The anaesthetic was administered by a physician. The patient had taken chloroform twice before without any bad effects. In all, but two drams were used. All attempts to restore the patient by the use of nitrite of amyl and artificial respiration were of no avail. The physician remarked immediately after the extraction of the tooth, "I hate giving chloroform for you dentists, because you will have your patients sitting up." Both the dentist and the physician were exonerated by the jury which was called to hold an inquest. The evidences of the danger in the administration of chloroform are so overwhelming, except in a very few cases, that no one is justified at the present day in using

it in so simple an operation as the extraction of a tooth; and a jury would be doing its full duty in holding responsible for the death of the patient any physician or dentist who administered it in such a case, with a fatal result.

ONE OF THE DIFFICULT problems which presents itself for solution in the south is how to reduce the mortality among the blacks. That it has not yet been solved is made evident by a study of the vital statistics of southern cities. These records show that the death-rate of the negroes is double that of the whites. Savannah, Ga., however, seems to be exceptionally unhealthy in this regard. It is stated that in that city, while the rate for the white population is but 12.19 per thousand, a remarkably low rate and probably not correct, that for the blacks is 122. If these figures are correct, there is opportunity for much missionary work of a sanitary nature in the city of Savannah.

ECONOMIC LAWS AND METHODS.

IF it should be said that the material out of which the science of mechanics was built was wood and stone, iron and steel, every one would see the mistake. But when Mr. H. C. Adams, in his interesting paper on economics and jurisprudence, speaks of the material surroundings of men and the legal structure of society as material out of which the science of economics is built, he falls into precisely the same error (*Science*, July 2).

It would be unfair to Mr. Adams personally to lay too much stress on a random expression torn from its context; but it is not unfair to the school of thought to which he belongs. We have singled this expression out for criticism because it is characteristic of the school. It represents a view of the whole subject which is likely to lead to grave mistakes in thinking and in action. That Mr. Adams himself will make those mistakes, we do not believe. We should be sorry to say a word which should even seem to detract from the value of his work. He is one of the few men who combine originality with critical judgment. But the high character of the writer makes it all the more necessary to protest against his mistakes, even though they be but incidental. What he does inadvertently, others will be led to do deliberately.

The error lies in confounding the material to which a science is applied, with the material out of which it is built; or — to put the same thing in another form — in identifying the material of a science with the materials of an art. In itself this may seem a trivial matter; in its consequences it is extremely serious.

The material out of which the science of mechanics is built is not wood or iron, in any sense whatever. The science is built out of a few simple laws of motion, nowhere *exactly* realized in nature, and yet now admitted by every sensible man to be true. And in like manner the material out of which the science of economics is built consists of a few simple laws of human nature, the chief of which is that men strive to obtain the maximum of satisfaction with the minimum of sacrifice. It does not insist that the sacrifice shall be solely physical, or the satisfaction purely material. It makes no more unwarranted assumptions than does pure mechanics. The 'economic man' has as much and as little real existence as the 'material point.' As the fundamental assumptions of mechanics are involved in the definition of motion and the fact of its measurement, so the fundamental assumptions of political economy are involved in the definition of motives, and the fact of their measurement. This measurement is far less accurate in moral science than in physical science: the danger of dogmatism is therefore greater, and the need for verification more constant. But to say that the verification *is* the science, is as much a mistake in the one case as in the other.

It is a mistake which is often made, and which does great harm, both in science and in practice. It defeats the usefulness of verification as a means of discovery. An illustration will help to make this clear. The discovery of Neptune was due to a study of the motions of Uranus. It was found that these motions were not exactly such as the laws of mechanics, applied to the position of the known planets, would explain. It was therefore assumed that there must be certain unknown conditions which entered into the case; and careful reasoning led to the discovery of a new planet, whose position and size fulfilled those conditions.

Now, let it be observed, that, by the method which the historical school so highly commends, the inference from the motions of Uranus would simply have been that the law of gravitation *was not as rigid as is commonly supposed.* Such an inference would not merely have been wrong in itself, but it would have prevented the discovery of Neptune.

It is only when you assume a rigid law that your verification leads to new discoveries; and it leads to the most fruitful discoveries where the law at first seems to fail. That these new discoveries may sometimes take such a form that the old statement of the law will need to be partly or wholly

rejected, does not alter the case. The man who tries to reason without rigid hypotheses cripples his power of investigation. Any one who understands the real power and importance of verification is justly indignant at any such conception of science as will prevent the use of verification as a means of discovery. The failures of the attempt to work without rigid hypotheses, from Lord Bacon down, have been so conspicuous that they hardly need repetition. Where the German school of economists has made any advance in the field of political economy itself, it has been done by an abandonment of the so-called historical method, and by a rigid application of deductive reasoning combined with careful verification. It is Cohn, and not Roscher, who represents the really fruitful line of German thought; and, whatever Cohn may at times have professed, he relies strongly both on abstract reasoning and on the rigidity of law.

There is one class of cases where these distinctions fall away, and where the Baconian method is a good one. When a science is so crude as to be mainly occupied with description and classification, there is little chance for the use of rigid hypotheses. Here the distinction between the material and the science falls away. Physics remained in this condition till the seventeenth century; chemistry, till the eighteenth; it was not till the nineteenth that 'natural history' began to give place to biology.

Sociology as a whole can hardly be said to have advanced beyond this stage; but certain departments of sociology are distinctly beyond it, notably law and political economy. They have reached the point where it is possible to frame hypotheses and to carry out deductions and verifications. The field of each science is limited; but, within its proper sphere, each is a true science. It is right enough to say that each is a part of something greater. In the future we may hope that a scientific sociology will be developed which shall include many other sciences. But we have a science of political economy, and we have not as yet a science of sociology in any thing like the same sense. To reject the part which we have for the sake of the whole, which we have not, would be the extreme of folly. It would be the same thing as to have rejected the undulatory theory of light fifty years ago because the correlation of forces was not yet discovered. The theory of light was but a part of the truth; but it was only on the basis of such parts that the whole could be built up. A scientific part is a better starting-point than an unscientific whole.

There is another class of dangers to which we are exposed when we deny all independence to economic reasoning. The man or state that refuses to recognize the rigidity of economic laws is likely to suffer for it, sooner or later, in his practical experience.

It is impossible for a man not to let his habits of thought affect his habits of action. If he is accustomed to make rigid assumptions, he tries to make things conform to these assumptions, and to insist that something is wrong where they do not. If, on the other hand, he reasons loosely, he comes to act recklessly, and to believe that his own luck or skill will save him from the necessity of careful calculation. The error of reckless overconfidence is at once more destructive and more common than the error of fatalism; and any thing which encourages the former is usually more dangerous than that which encourages the latter.

If a nearly spent cannon-ball is slowly rolling toward you, the natural and sensible thing to do is to get out of the way. The fatalist may refuse to do so because of his blind belief in fate. The fool may refuse to do so because he thinks it is not coming fast enough to hurt him. Now, either extreme is bad; but the practical danger is from the latter. The experience of army surgeons will show that in the instance given there are probably ten fools to one fatalist.

And in like manner the danger of believing that economic laws can be interfered with by human effort is ten times greater than the danger of an extreme belief in *laissez-faire*. Human nature is far more inclined to the former error. Where the economists make a mistake in opposing state interference (as when they tried to stop English factory legislation), people will generally take their own course in spite of them. Where they make the mistake of not opposing it, people will be only too ready to seize upon their arguments. And the same thing holds true of individual action as well as of state action. The danger of believing that the results of past experience are uncertain is far greater than the danger of believing that we are helpless to improve upon them.

As a matter of fact, there are limits within which the results of past experience are surprisingly rigid. That the worse currency drives out the better; that food prices depend upon the margin of cultivation rather than upon rent; that reckless marriage means starvation wages, — are laws which nations have been for centuries attempting to disregard, and of which they are hardly yet learning the full force. They mark limits, and effective limits, upon legislative activity. As long as political economy is occupied with defining those limits, it can maintain its claim to the position of an authoritative science. It says to the legislator, 'Thus far shalt thou go, and no

farther.' It does not say, 'Such and such legislation will produce the best results;' but it says, 'Beyond certain limits, all legislation fails.' This is the natural relation of a science to an art. Mechanics does not tell the bridge-builder exactly how he must build his bridge; considerations of beauty and convenience must be taken into account: but mechanics warns the builder, that, if he disregards certain conditions of stability, his bridge will fall. Nobody insists that the axioms of mechanics should be modified because a bridge with the maximum of stability would be inconvenient or unsafe. Nor do we insist that mechanics should solve all the problems of bridge-building. We let mechanical considerations limit the practical application of aesthetics, and we let aesthetic considerations limit the practical application of mechanical principles. We do not attempt to fuse the two things together, and then distrust both of them.

This may fairly illustrate the relation of economics and jurisprudence. Whether we shall ever be able to combine them into one science may be uncertain; but we have not been able to do so as yet. Each limits the practical application of the other. Industrial activity is limited by legal conditions; legislative activity, by economic conditions. The attempt to confuse the two, and to merge them in a crude science of sociology, seems for the present likely to check scientific progress, and to involve us in serious practical dangers. Each, as a science, is independent, authoritative, and rigid; each forms the basis of an art which is subject to a thousand limitations.

ARTHUR T. HADLEY.

CONVOCATION OF THE UNIVERSITY OF THE STATE OF NEW YORK.

THE twenty-fourth convocation of the University of the state of New York began its sessions in the senate chamber of the capitol at Albany on Tuesday morning, July 6. There was assembled a large number of college professors, normal and high school teachers, and friends of education, from New York and other states.

The address of Hon. Henry R. Pierson, chancellor of the university, was a very able and eloquent defence of the work of the university and its board of regents, having special reference to the proposal recently made to abolish them both. The chancellor examined in some detail the history and organization of Oxford, Cambridge, and London universities. He showed that these universities stand in precisely the same relation to the federated colleges under their control that the University of the state of New York bears to the high schools, academies, and colleges of the state. The history of the university amply justifies its existence. Starting in 1784 with only one weak college — King's college, now Columbia — under its control, it embraced, in 1885, 45 colleges having 784 instructors and 11,702 students, and 1,571 graduates during the year. The total value of this college property is $23,164,612.82, and their yearly expenditure amounts to $1,787,391.51. Besides this, there were, in 1885, 283 academies under the control of the regents of the university, and 72,426 answer-papers were examined and passed upon under the supervision of the regents during the year. The chancellor stated that post-graduate courses, with corresponding examinations and degrees, were now under consideration. He concluded, "Read the record of these convocations, and I venture to say that no similar records of educational value can be found. Shall we consider these convocations a failure and nothing worth? It is true, the university does not confer many degrees, because that is a power concurrent with the colleges, and it has been thought best to leave that duty mainly with them. I think I have proved that in its past and present the duties of the university have been defined by law, and that it has performed all the duties devolving upon it; that the corporate name is not a misnomer, and should not mislead; and that the regents are doing too noble a work to be abolished or merged with any other body of educational workers."

The main interest of the first morning session centred in the discussion of the subject of manual training, which was introduced in a paper by Principal Love of Jamestown. Mr. Love claimed that the test of the practicability of manual training must be its usefulness. Any system of training that does not start out with the idea that the scholar must become a producer is defective. Principal Love detailed the workings of a system of manual training introduced by him in Jamestown, asserting that it did not detract from, but rather added to, the quantity and quality of intellectual work performed by the pupils. His account showed a gratifying success with an experiment which must sooner or later become general.

The afternoon session was given up to a discussion of the question, 'Has the college a logical place in the American system of education?' The subject was introduced by papers by Prof. Oren Root of Hamilton college and Prof. S. G. Williams of Cornell. Both essayists, as well as Vice-Chancellor MacCracken of the University of the city of New York, who opened the discussion of the papers, combated the view expressed in some quarters, — notably by Professor West of Princeton, in a paper read before the National teachers' associa-

tion at Saratoga in 1885, — that the work of the college would ultimately fall to the academies and universities, and the college itself fall away as unnecessary. In opposing this view, all the speakers were agreed that the college continues and completes the boy's education, begun in the school and academy, while the university trains educated men in special branches. Professor Williams attributed much of the misunderstanding on this subject to the fact that many colleges were forgetting their true position and function in their endeavor to become universities. Professor Williams said that the ideal college course would, in his opinion, call for sixteen hours of recitation per week, devoted as follows: language, one-half; mathematics (meaning algebra, geometry, and trigonometry, and these only), one-eighth; history, a little more than one-eighth; and elementary science, including civics and psychology, a little more than one-quarter. To such a curriculum elocution and gymnastics could easily be added, and it would serve to train the pupil as the college ought to train him, and did train before it was carried away by a wrong ambition.

For Wednesday morning's session, Dr. L. Sauveur was announced to explain and defend the 'natural method' of teaching languages. He was not able to be present, and Mr. C. W. Bardeen briefly presented the chief points of excellence in connection with the natural method. Principal George C. Sawyer of Utica followed with a scholarly and exhaustive attack on the 'natural method' as a fraud and a sham. Dr. Sawyer claimed, that, under this method, all the work devolves upon the teacher, and the pupil picks up, with no disciplinary training, a parrot-like acquaintance with a limited vocabulary. Moreover, the main value from studying a language lies in learning to read it, to imbibe the thought and spirit and culture of another people, and not merely to hold a conversation in it.

The discussion was continued by Professor Wells of Union college, Principal Farr of Glens Falls, and Principal Cheney of Kingston, all of whom opposed the so-called 'natural method,' and defended the old or rational method both because of its practical results and its disciplinary training.

Dr. James Hall, director of the New York state museum of natural history, followed with a brief account of that museum and its educational work. Dr. Hall said that it represented every department of natural history. The mineral wealth of the state should also be represented. Nearly ten years ago there were distributed to schools and colleges about twenty thousand specimens in geology and mineralogy, and the museum is now prepared to distribute about five thousand more authentic specimens, which is a valuable adjunct to the teachers' work in these schools. In this way the educational use of the museum is manifested by its publications and its distributions of specimens. The museum will continue to aid the cause of education and be a part of the educational system of the state. Teachers and investigators are invited to seek assistance and information of the museum; and, if institutions want collections augmented from its duplicates, the museum of Albany will be glad to respond as readily and as heartily as it can.

Principal C. T. R. Smith of Lansingburgh presented a paper, which was an able exposition of the desirability of allowing plane geometry to precede algebra in the regents' course of study. Professor Root of Hamilton agreed with Principal Smith, and showed clearly by concrete examples how the logical and natural order would be restored by the proposed change. Considerable discussion followed, the general sentiment being that the change should at least be permitted as an alternative even if not sanctioned entirely.

An unusually large and brilliant audience assembled in the evening, when President McCosh of Princeton was announced to deliver an address on elective studies in college. Dr. McCosh opened with the proposition that a college or university should, so far as its funds would permit, offer instruction in every branch of literature and science, carefully excluding all that is merely showy. Modern education, he continued, began in the seventh century with the foundation of the Cathedral schools with their Trivium and Quadrivium. At this time there was no possibility of electives, because during its course the university of that day could teach all that was known. A new era began with the Renaissance, and again in the seventeenth century the subjects of study were greatly increased by the new mathematics of Descartes, Newton, and Leibnitz. In the eighteenth century were founded the Royal society in England, the French academy, and the Berlin academy of sciences. Chemistry, biology, and botany became sciences, and were placed in the curriculum. This great increase in subjects of study has gone on, until, in our day, it is absolutely impossible to master them all. The age of universal scholars, of Erasmus, of Scaliger, of Leibnitz, has gone never to return.

Having established the fact that an elective system is now necessary in our colleges, the further question arises, how is it to be regulated? Having reference only to candidates for the B.A. degree, which implies a general culture and scholarship, the standard of which we must not allow to be

lowered, we may say, first, that there should be prescribed studies in every year of the college course. These must embrace what experience has proven the fundamental and disciplinary studies, both for the purpose of training an accurate and scholarly mind and for bearing practical fruit. The principal of these is language. Our own language should have the first and the last place in every scheme of instruction, but every educated man should know at least two languages in addition to his own. The Greek language should by all means be maintained as a requisite for the degree of B.A., as being the most perfect and subtle of languages, and as being the medium of the grandest literature of the ancient world. In the second place, no man is a scholar who has not studied mathematics: therefore they should be prescribed in a certain degree. And, thirdly, no man is educated who has not some knowledge of philosophy, including under this head the social and political sciences. With a well-arranged plan of obligatory studies, embracing language, science, and philosophy, should be combined an indefinite number of elective studies. No electives should be permitted in the freshman year. This year should be spent in the thorough mastery of the elementary branches and in becoming acquainted with the general system of the college, so that the pupil may be prepared to make his choice of studies later an intelligent one. Only a few electives may safely be allowed in the sophomore year, but in the last two years of the college course they may be freely introduced. In this elective system, however, the student should not be allowed to dissipate his energies in too many directions. Four electives at most should be allowed him.

While this should be firmly adhered to in the course leading to the B.A. degree, other courses should be encouraged, and corresponding degrees awarded on their successful completion. Each of these degrees should be plainly designated by its title, so as not to be mistaken for the B.A. degree.

Our students in colleges are not increasing in proportion to the population. One reason is that they enter college too late, and it is only at the age of twenty-six or twenty-eight that they are able to support themselves by their profession. This is longer than most boys can wait, and longer than most parents can afford to have them wait: so they are dispensing with the college course. The remedy for this is to improve the work of the schools so that a boy can enter college at sixteen, and enter on his profession at twenty-two or twenty-three years of age. A healthy boy of fair ability ought to be able to accomplish this without difficulty.

Dr. McCosh's argument and practical suggestions were most favorably received by the members of the convocation.

On Thursday morning, July 8, the convocation held its closing session. Professor Hewett of Cornell read a paper on the relations of the colleges and academies, in which he pointed out the fact that the systems of Germany, Massachusetts, and Michigan, were superior to those of New York as far as the relations between preparatory schools and colleges are concerned. He urged that the colleges should unite in setting a standard which the high schools and academies would have to observe or else give way to private schools. Inspection of preparatory schools by competent officers was also recommended.

On the conclusion of the discussion of Professor Hewett's paper, Chancellor Sims of Syracuse university took the chair, and opened the conference of college presidents in the state of New York on the question of classical requirements for the degree of B.A. He was followed by President Dodge of Madison university, Warden Fairbairn of St. Stephen's college, and Brother Conway of Canisius college. Every speaker took the ground that the reputation of the B.A. degree must be preserved, and that Greek and Latin must be rigidly insisted on as requisite for its attainment.

The last business of the convocation was to discuss briefly medical education, the sentiment being that a physician should be examined for his license to practise by a board not composed of his instructors. At one P.M. Chancellor Pierson declared the convocation adjourned *sine die*.

Among the other papers of interest were the following: Rev. Brother Noah, Tact in teaching; J. A. Lintner, The present state of entomological science in the United States; President Hyde of Bowdoin, The relation of higher education to religion; Professor Wilson of Cornell, The elements of knowledge; Principal E. H. Cook of Potsdam, Systematic habit in education.

THE INDIAN SURVEY REPORT.

THE general report on the operations of the survey of India for the year 1884–85, which has been received from India a month earlier than usual, contains the record of work done by one of the busiest departments of the government of that country, the following abstract of which we find in *The Athenaeum*. The officers of the department are constantly engaged in surveys in all parts of the peninsula, and every year a greater area is added to the map as either triangulated or topographically surveyed. Our attention may be most profitably directed to the geographical discoveries chronicled in the present report, although they do not include any thing so remarkable as

the journey of A. K. in the report of two years ago.

Prominent among the additions to our geographical knowledge is the survey made by the officers of the Afghan commission of the country between Quetta and Kuhsan on the Perso-Afghan frontier. This independent traverse was for a distance of 767 linear miles without a break. The Helmund valley was mapped up to the Hamun; and Major Holdich, with his assistants Captains Gore and Talbot, has plane-tabled an extent of 15,000 square miles in this part of Afghanistan. But the most distinct achievements of the year were attained on the northern and eastern frontiers of India. Colonel Woodthorpe's trip across the Patkai range to the villages of the friendly Bor Kamptis, in the valley of the western branch of the Irrawaddy, was a perilous but successful attempt to carry one stage further the examination of the country beyond the north-east frontier. The history of this tour is given by Major C. R. Macgregor in the appendix, which consists of the narratives on which Colonel De Prée has based his general report. The country through which the expedition had to pass *en route* to the Kampti villages was the scene of many Singpho depredations; and more than one place was indicated by the guide as having witnessed the massacre of helpless Kampti traders, and fear of the Singphos was generally assigned as the cause of the absence of trade between the Brahmaputra and Irrawaddy. At Langnu, the first Kampti village, the party, after some not unnatural hesitation considering it was a surprise visit, was favorably received, and made the acquaintance of representatives of several new tribes, such as the Marus, who are extremely poor and live on roots in some hills south of the Namkiu valley, and the Kunnungs, described as a gentle and pleasant-looking people with melodious voices. In the country of the latter, silver-mines exist, which supply the whole of this region with coin and ornaments. Just as the Singphos raid on the Kamptis, a people called the Singlengs plunder the Kunnungs, and sell those they capture as slaves to the Tibetans. At Langdao the party was obstructed; but the people were pacified by fair words and the present of some rupees to propitiate their 'Nats.' Near this village Colonel Woodthorpe crossed the Irrawaddy or Namkiu, which at this point is only eighty-five yards broad and not deep. China is known as Khé Moung, and the tribes only resort there — a journey of a month and eight days — for the purpose of buying opium; and that not so often as formerly, because Assam opium is found to be better and more easily procurable. The explorers received a polite message from Lukun, the head chief of the Kamptis, to visit him in his capital of Padao. The chief is described as 'a fine-looking shrewd old fellow,' who originally came from Bhamo, and whose assistance will prove of great utility in exploring the country beyond his territory in the direction of the silver-mines. The return journey across the Patkai range was attended with great difficulty and peril, as the rivers were flooded, and supplies were almost exhausted. In fact, when the expedition joined a party sent out to relieve them, they were on the verge of starvation. Major Macgregor expresses the opinion that the idea of a trade-route to China from Assam is any thing but a visionary one; and the more knowledge we acquire about the tribes of this region, the more reasonable does it appear that there may, after all, be a short route between Assam and the province of Szchuen.

Captain Wahab's narrative of the Baluchistan operations is chiefly interesting for its reference to the passes in that country between the fertile planes of Kachhi and Khelat proper. The Gazak pass, which leads direct to the Khan's capital, will be surveyed later on; but farther north the Vehova pass has been examined, with the result that it has been found a good road, passable for laden camels, and with good water, grass, and fuel. The writer calls attention to the great change that has taken place in the security of the district through which the Pishin railway is now being constructed. A few years ago this was one of the most lawless tracts on the frontier: now camps of coolies are scattered along the whole line quite unguarded, and apparently as secure as if they were in India.

Colonel Tanner's account of the Himalayan survey is very interesting reading; and his forced march across the Lipu Lek pass brought him into direct contact with a Tibetan Jongpen or governor, who used plain language regarding the attempts of the English to enter his country. He said, "We are not angry at your coming this once, but we never wish to see you again. Our government don't allow the English in Tibet, but you one and all try to push your way past our frontier posts." If this expresses the Tibetan view of the subject, it is to be feared that Mr. Colman Macaulay has not much chance of succeeding in his mission. Colonel Tanner gives a graphic description of the village of Budi — the most delightful place he had seen in the Himalayas — and of the terrors of the Nirpania-kidanda, or waterless spur, which occurs between the Lipu Lek pass and Kumaon. The most important piece of work in this direction was accomplished by a surveyor named R. N., under Colonel Tan-

ner's direction. This explorer made a circuit of the great mountain Kinchinjinga, delineated the boundary between north-east Nepaul and Tibet, fixed the peak of Nuijin Sangra, and completed the sketch of the Zemu River. Colonel Tanner's surveys are particularly interesting as establishing the accuracy of those made by A. K. Our brief account will serve to indicate how much interesting matter is contained in this report.

A SALT-MINE IN WESTERN NEW YORK.

MR. WILLIAM FOSTER, jun., of New York has at last succeeded in sinking a shaft to the salt deposits of central New York. As I was permitted a few weeks ago to descend to the mine, I will, by the owner's permission, give the facts to the public so far as they are of scientific and general interest.

This is, I believe, the first successful attempt to mine the salt deposits of this region. In the neighborhood of Syracuse no salt deposits have been found; but the dependence is wholly upon salt springs which derive their salt from unknown sources. In the valley of the Genesee, in Livingston county, about thirty miles south of Rochester, deposits of salt were penetrated some years ago, in boring for oil, at a depth of about a thousand feet; and numerous wells have been bored from which brine is pumped, both there and in Wyoming county to the west. Previous attempts to sink shafts to these deposits in Canada have encountered so much water, that the projects have proved impracticable; but the present attempt seems to be entirely successful. The shaft was sunk 1,013 feet; and the mine is perfectly dry, with the exception of a little water which drips down the shaft. An inch-and-a-half pipe removes all the water. When I visited the mine in April last, they had drifted about 300 feet in each direction. The stratum of salt in which they are working is twenty-two feet thick, and fourteen feet of it is pure salt. The miners remove it by blasting (boring holes with augers specially adapted to the purpose, and inserting small charges of dynamite). I collected some of the dust which was coming from one of these holes, which had penetrated about four feet horizontally and about midway between the top and the bottom. This has been analyzed for me by Professor Jewett of Oberlin, with the following result: —

	PER CENT.
Sodium chloride	97.84
Calcium sulphate	1.04
Moisture	.08
Residue insoluble in water	.43
Magnesic sulphate	trace
Total	99.39

This is remarkably free from impurities, even for refined salt. Doubtless, by selecting specimens, a still greater purity might have been obtained. The above specimen fairly represents the purity of a stratum fourteen feet thick, which is now being mined without hinderance from any causes.

Other strata of salt were found both above and below this one. The upper stratum was reached at a depth of 991 feet, and was so mixed with shale as to be unprofitable. The lower stratum was reached at 1,047 feet, and is fifty feet in thickness, being practically clear salt. Between these two there was also a four-foot stratum of clear salt. Thus, in all, there is, within a distance of two hundred feet, not far from eighty feet of solid salt at a depth of a little over a thousand feet below the surface. The shaft begins in Hamilton shale. The following is the record: —

	Thickness in feet.	Depth in feet.
Shale	407	407
Corniferous lime rock	148	555
Shale	223	778
Limestone and shale	70	848
Shale	102	950
Lime rock	11	961
Shale and salt	30	991
First bed clear salt	22	1,013
Lime-rock and shale	28	1,041
Second bed clear salt	4	1,045
Rock	2	1,047
Third bed clear salt	58	1,105

This mine is at Piffard Station, Livingston county, on the Buffalo, New York, and Philadelphia railroad. G. F. WRIGHT.

LONDON LETTER.

THE movement previously referred to in this correspondence, for promoting such changes in the University of London as will bring the teachers of the various colleges into closer relations than at present with the examiners, has just made a great step in advance. At a meeting of convocation (i.e., of the general body of graduates) on June 29, a scheme was adopted, and sent on to the senate (the executive body) for consideration. It proposes, 1°, that the constitution of the senate be enlarged by the direct representation thereon of certain educational bodies in and near London, such as University college and Kings college, London, the Royal college of physicians and of surgeons, the Royal society, the council of legal education, etc; 2°, that certain colleges shall, under the title 'constituent colleges,' form a part of the university; 3°, that a council of education shall be established, consisting of repre-

sentative graduates, representatives of these constituent colleges, the examiners, which shall advise the senate on all matters relating to the subjects of examination, and shall appoint boards of studies; 4°, that the university (now entirely dependent on fees and a treasury grant) shall have power to hold real property, in order that it may assist by any suitable means in promoting higher education. Except on the question of the admission of women to degrees, there have never been debates in convocation at which more interest has been shown. At the present moment, a keenly contested parliamentary election is being carried on in the university. The poll is open for five days; the voting is open, and may be done in person, or by voting-papers sworn before a justice of the peace and then sent in by mail. Sir John Lubbock, F.R.S., formerly vice-chancellor, represented the university for many years as a liberal, but not a 'home-ruler;' and he is now opposed by Mr. Frederick Harrison, the Gladstonian candidate.

In connection with the Colonial and Indian exhibition, a very useful series of conferences are being held in the Conference hall of the exhibition. Many of these are devoted to an exposition of the resources of some particular colony — to various industrial products and questions — and to such subjects as the federation of the colonies, etc. One day was devoted to the subject of the position of science in colonial education, which was introduced in a very exhaustive paper by Mr. William Lant Carpenter.

The colonies to which Mr. Carpenter had directed his attention were, Canada generally; in South Africa, the Cape of Good Hope and Natal; western and South Australia, Victoria, New South Wales, Queensland, New Zealand, and Tasmania; the last of which, unfortunately, was not represented at the present exhibition. An account of the present condition of scientific education in each of these colonies was given, in primary, secondary, and grammar or high schools, in colleges and universities, and in museums, etc., for adults. The most perfect scheme of education was probably that of the little colony of New Brunswick, which was admirably arranged. This colony spent one-third of its entire revenue on education, and one-eighth of its entire population in 1885 received instruction in hygiene. There was a universal desire in the colonies to realize as far as possible Professor Huxley's idea that a system of public instruction should be an educational ladder reaching from the gutter to the university.

As a general conclusion, Mr. Carpenter thought that the claims of science to a place in state-aided primary education were more fully recognized than in the old country; and this, not merely because it was the only foundation upon which a system of technological education could be securely built, but for its value in drawing out the minds of the pupils. As regards the branches by which the time-honored routine of subjects may be most beneficially varied, precedence was almost universally accorded to drawing, and to the objective presentation of the elements of science. In secondary grammar and high schools, science scarcely occupied a position equal to that in corresponding English schools; but there were many signs of improvement in this respect. In the colleges and universities of the older colonies, the classical and academic influence was still very strong, while in the newer ones the claims of scientific education to be put on an equal footing with literary were recognized. Great as had been the progress of public opinion in England during the last few years on the importance of science as an element in education, the author was disposed to consider it greater in the colonies in the same period. Certainly the development of that opinion to its present point had been much more rapid in the colonies than at home. There were many voluntary colonial associations for the promotion of science; and the author concluded his paper by throwing out the suggestion, that, if there were grave and practical difficulties in the way of an imperial federation of the Australian colonies, the establishment of an Australian association for the advancement of science, somewhat on the lines of the British and American associations for similar purposes, might not be beyond the reach of practical scientists; and he was strongly of opinion that such a federation would tend to strengthen 'the position of science in colonial education.'

The annual meeting of the Society of chemical industry is about to be held at Liverpool. The success of this society, which was only founded five years ago, has been remarkable, chiefly because it met a great want. It numbers over two thousand members, some resident in remote parts of the world. It has sections in the chief manufacturing districts of England and Scotland, such as Newcastle, Manchester, Birmingham, Bristol, etc. Its journal, issued monthly, is a very valuable record of industrial chemistry; the abstracts of patents, and of papers in foreign journals, being a special feature in it.

The experimental farm of the Royal agricultural society has recently been visited by distinguished colonists, as well as officially by the members of the society. It was started in 1877 to put to a practical test the relative manurial values attributable to the consumption of certain feeding-stuffs, which, on chemical considerations, should

differ widely in their fertilizing effects on the farm. Among the manurially rich food, decorticated cotton cake has been employed. One important economical fact has been clearly brought out: viz., that even heavy dressings of concentrated soluble nitrogenous manures, whether ammonium sulphate or sodium nitrate, leave in the soil, when applied to cereal crops, no appreciable residue for the use of a succeeding crop. W.

London, July 3.

NOTES AND NEWS.

THE thirty-fifth meeting of the American association for the advancement of science will be held at Buffalo, from Wednesday morning, Aug. 18, until Tuesday evening, Aug. 24, 1886. For the third time, at intervals of ten years each, the association has accepted an invitation to hold a meeting in Buffalo. The local committee intend to make the meeting a great success; and members who were at the meeting of 1876 need only to recall it, in order to form an idea of what the coming meeting promises to be. To those who were not present, it is only necessary to state that the facilities which the city offers are all that can be desired, both in regard to rooms for the several sections and in hotel accommodations, while the health and comfort of the city in the month of August are well known. The headquarters of the association will be at the high school, and all the offices and meeting rooms will be in that building or in one of the schoolhouses near by. The hotel headquarters will be at the Genesee house. Board and lodging for members and their families may he had at the rate of $1 to $3 a day, and reduced rates have been obtained from many railroads. A special circular in relation to railroads, hotels, and other matters, has been issued by the local committee. In order to take advantage of these arrangements, members who have not received the local committee's circular should send for a copy at once. Arrangements for excursions and receptions will be announced by the local committee. The officers of Sections D and H have issued special circulars relating to the meeting, which can be had by addressing the respective secretaries. Special information relating to any of the sections will be furnished by their officers. In Section E special attention will be given to the problems connected with the Niagara Falls and its gorge.

— Two Italian physiologists have recently been experimenting upon the effect of various drugs on the sense of taste. They find that the prolonged application of ice removes the sensibility for all tastes, — sweet, sour, salt, and bitter. The effect of cocoaine is to destroy the sensibility for bitter only. All other substances can still be tasted, but the application of a bitter substance yields only a sensation of contact. The removal of the sensibility remains the longer, the longer and more intense the application of the cocoaine. Of course, the effect is only transient. They find other substances that reduce the sensibility for bitter taste; but cocoaine seems to be the only one which selects all the fibres that conduct the sensation of bitter, and paralyzes them. Other substances, such as caffeine and morphia, diminish the discriminative sensibility between different intensities of bitter. The application of a two-per-cent solution of sulphuric acid has a peculiar effect. It makes distilled water taste sweet, and even makes a quinine solution have a sweet taste, but this only at the tip of the tongue; elsewhere it tastes bitter, as usual. These experiments are particularly important because they are the first that promise a rational application of the law of specific nerve-energy to the sense of taste. They seem to suggest the supposition of separate fibres for the conduction of separate tastes, and thus make close connection with the recently discovered hot and cold points in the skin, which are the terminal portions of nerve-fibres for the separate conduction of sensations of heat and cold.

— Protap Chandra Roy of Calcutta, secretary of the Dātavya Bhārata Kāryālaya, has issued an appeal for aid in rescuing the ancient Indian literature. The Dātavya Bhārata Kāryālaya has, within the course of the last eight years, printed and gratuitously distributed two editions of the Mahābhārata in Bengalee translation, each edition comprising nearly three thousand copies. The fourth edition of the Mahābhārata (the third of the series for gratuitous distribution) has been commenced, and it will take some time before it is completed. One edition of the Harivānça, comprising three thousand copies, has been exhausted. The Rāmāyana also, that was taken in hand, has been completed, the text of Valmiki being published with a translation. Roughly estimated, the Bhārata Kāryālaya has distributed up to date nearly twelve thousand copies of the Rāmāyana, Mahābhārata, and the Harivānça taken together, and that number will swell to eighteen thousand, when the fourth edition of the Mahābhārata shall be complete. Leaving aside the arithmetical results of the Kāryālaya's operations, it might fairly be presumed that the genuine demand for eighteen thousand copies of the sacred books of India represents a degree of interest taken by the people in the history of their past that is certainly not discouraging. An English translation of the Mahā-

bhārata in monthly parts has been begun; and twenty-two parts have already been issued. To insure permanency to the Bhārata Kāryālaya, it is necessary to collect funds. Contributions may be sent to W. E. Coleman, San Francisco; to Prof. H. Jacobi of the University of Kiel; to M. A. Barth of 6 Rue du Vieux Columbier, Paris; to Prof. Max Müller, 7, Norham Gardens, Oxford, England.

— Captain Grimes, British steamship Humboldt, Rio de Janeiro, to New Orleans, reports, under date June 10, witnessing a battle between a large sperm-whale, thrasher, and sword-fish. The vessel was in latitude 13° 25′ south, longitude 36° 16′ west, off San Salvador, Brazil. The fish were far off, and would not have been sighted were it not for the great commotion occasioned by the fight. The steamer ran down to the combatants, and lay to till the end of the battle, resulting in the death of the whale and sword-fish.

— Mr. Douglas Home, the well-known medium, died June 21, at Auteuil, at the age of 52.

— Letters from Colonel Lockhart's party give a complete contradiction to the story of his arrest. The mission was well received by the Afghans, who proved very friendly.

— It is proposed to hold in the autumn of 1887 an international congress of shorthand writers of all existing systems, and of persons interested in shorthand generally, to celebrate conjointly two events of importance: 1. The jubilee of the introduction of Mr. Isaac Pitman's system of phonography, marking as it does an era in the development of shorthand on scientific principles; 2. The tercentenary of modern shorthand originated by Dr. Timothy Bright about 1587, continued by Peter Bales (1590), John Willis (1602), Edmond Willis (1618), Shelton (1620), Cartwright (1642), Rich (1646), Mason (1672), Gurney (1740), Byrom (1767), Mavor (1780), Taylor (1786), Lewis (1812), and many others in past generations, and finally by Mr. Pitman and other English and continental authors of the present day.

— The rapid development of the technical sciences and the specialization of the various departments of civil engineering of late years have so enlarged its field as to make it desirable that the student should be allowed some freedom of choice as to the particular line of work to be specially pursued in the application of these general principles. To meet this requirement, the Massachusetts institute of technology has arranged a general course of study, covering the whole field of civil engineering, adapted for those students who have not decided what special branch they will afterward pursue, while it affords at the same time an opportunity for those students who desire it to devote themselves more extensively to certain special branches.

— Applicants for admission to the dental schools of Great Britain must pass a satisfactory examination in English grammar and history, in Latin, in algebra, geometry, and physics; and, before they can receive their degree of L.D.S., they must study for four years anatomy, chemistry, surgery, and such other branches as are taught in the medical schools, besides those which specially pertain to dentistry, as operative dentistry, the administration of anaesthetics. In London there are two dental hospitals in which all the operations known to that branch are practised, and to which students have admission and opportunity to operate. In the National dental hospital, during the year 1885, 9,001 fillings were inserted, of which 1,014 were of gold, the others being of gutta-percha or other plastic material.

— Consul-General Gibbs of Bolivia has given a very interesting account of the coca-plant, which is now so much employed in medical practice, and which, together with opium, chloral, and other drugs, is beginning to gain its victims from the ranks of those who, having commenced its use for medicinal purposes, have become so enslaved by it that they cannot give it up. This plant is grown in the province of Yungas, and brought some sixty miles to Lapaz, Bolivia, which is the great market for it. The bushes, which are grown on the sides of the mountains, furnish three crops a year of the leaves, from which the drug is obtained. The leaves are dried in the sun, and, after being pressed, are packed in bales. The annual production is 7,500,000 pounds, of which Bolivia consumes fifty-five per cent; the United States and Europe, five per cent; and the rest is consumed in other parts of South America.

— The Entomological club of the American association for the advancement of science will hold its meetings during the week of the association in the library of the Buffalo society of natural science. The first meeting will be held on Tuesday, Aug. 17, at 2 P.M.; and Prof. J. A. Lintner, president of the club, will deliver his address at that time. During the week there will be an excursion to some point of interest; and a reception has been tendered the club by the entomologists of Buffalo. It is very desirable that those entomologists expecting to attend should signify their intention to the secretary of the club, John B. Smith, national museum, Washington, D.C.

— The Botanical club of the American association for the advancement of science will hold its meetings, as usual, during the week of the association. The first meeting will take place on Wednesday at 9 A.M. in the room assigned to the biological section. Any botanist or person specially interested in botany, who is a member of the association, and has registered for the Buffalo meeting, may become a member of the club by filling out a blank to be obtained at the desk of the local committee. The plans for excursions are not yet matured. For further information address Dr. J. C. Arthur, secretary of the club, Geneva, N.Y.

— The Society for the promotion of agricultural science will hold its seventh annual meeting in Buffalo, beginning on Tuesday, Aug. 17. For further information address Dr. Byron D. Halsted, secretary, Ames, Io.

— The present custodian of the Cincinnati society of natural history, Prof. Joseph F. James, has resigned his position to accept the professorship of botany and geology in the Miami university, Oxford, O. The executive board of the society have appointed a committee to receive applications for the position, and to examine the credentials of applicants.

The *Athenaeum* announces that Prof. Karl Pearson will contribute a volume to the 'International series' which will be to physics what Professor Clifford's 'Common sense of the exact sciences' (which Professor Pearson edited) is to mathematics, and will, in fact, form a companion work.

— At the meeting of the Académie des sciences, May 31, MM. Cailletet and Mathias read a paper entitled 'Researches on the densities of liquefied gases and of their saturated vapors.' They have followed the researches of Faraday, Thilorier, Bussy, and D'Andreif upon the density of the liquid gases. The apparatus they have employed was of great simplicity, all of glass, capable of resisting the pressure of many atmospheres. The gases on which they operated were protoxide of azote, ethylene, and carbonic acid. Their results confirm those of M. Sarrau. The authors' experiments demonstrate that at the critical point the density of the liquid gas is equal to that of its vapor. M. Fizeau also stated that his observations taught him that the luminiferous ether is entirely unaffected by the motion of the matter which it permeates, and said that he hoped soon to announce the existence of a peculiar variation in the magnetic force of magnets, apparently in relation with the direction of the earth's motion through space, calculated to throw light on the immobility of the ether and its relations to ponderable matter.

— There are in the United States about one hundred medical colleges of good repute, at which more than ten thousand students attend annually. From these institutions go out each year from five to one hundred and fifty or more graduates, to swell the ranks of a profession which now numbers in the United States more than seventy-seven thousand members. For the additional instruction of these doctors there are published more than one hundred and fifty medical journals.

— From the *Medical news* we learn that a German physician was recently much puzzled by a case which he was called to attend. The patient, a child five weeks old, was incessantly crying, and was undoubtedly suffering from colic, and its skin was of a bluish color. Further examination revealed the fact that the nurse was in the habit of using a cosmetic in which lead entered largely as a constituent. This gave to her face a brilliant tint, which at once attracted the attention of the physician. The use of this cosmetic was at once interdicted, and in a few days the colic and the crying ceased.

— Instances of extreme old age are reported from Russia. The *Novosti*, a Russian journal, announces the death, in the almshouse of St. Petersburg, of a man, aged one hundred and twenty-two years, who had been an inmate since 1818. His mental faculties were preserved up to the time of his death, and his general health was excellent to the age of one hundred and eighteen, when he commenced to fail. There is in the same institution a soldier's widow whose age, as shown by documentary evidence, is at least one hundred and ten years. In our own country, at New Holland, O., Mrs. Arnold has just celebrated the one hundred and ninth anniversary of her birth; and her two sisters are still living, aged respectively one hundred and six and one hundred and twelve.

— Dr. Barlow, in the *Lancet*, expresses the opinion, after a very thorough investigation into the nature of whooping-cough, that it is to be classed among the diseases which are caused by the irritation excited by the presence of parasites; and that these are micrococci, which proliferate in large numbers upon the living membrane of the larynx and pharynx. He also claims for resorcine the power to greatly reduce the intensity of the disease, and to directly lead to its cure. This remedy, which is among the most recent introduced to the medical profession, is applied as a one or two per cent solution, either by a brush

or in the form of spray, directly to the mucous membrane of the throat and the larynx.

— Some of the friends of M. Chevreul propose to present him a medal on his hundredth birthday, which comes the 31st of August. This medal will bear in relief a portrait of Chevreul engraved by M. Roty. Subscriptions should be addressed to M. Louis Passy, secrétaire perpétuel de la Société nationale d'agriculture de France, 18, rue de Bellechasse, Paris, France.

— The *Athenaeum* states that Mr. Blanford, the meteorological reporter to the government of India, has drawn up a memorandum to accompany the charts of temperature and rainfall. The temperature being reduced to its equivalent at sea-level, the hottest tract in India is a portion of the Deccan plateau between Bellary and Sholapore. The hottest region of the peninsula is really the eastern coast from Vizagapatam southwards and the plains of the Carnatic and northern Ceylon. In intra-tropical India, except as modified by the elevation of the country, the temperature increases from the coast inland, the west coast being cooler than the east coast. Sind and Rajputana are the driest portion of India. In the greater part of India, May is the hottest month in the year, except in the Punjab and Sind, where, owing to the lateness of the rains, June is hottest. Of those stations, the temperature of which has been pretty accurately determined, the hottest in May is Jhansi: the coolest region is Assam, where the May rains are very copious. The mean annual rainfall of the whole of India is about forty-two inches, varying from nearly five hundred inches at Cherra Poonjee, to about three inches at Jacobabad. The provinces most subject to famine are the north-western provinces, Behar, Rajputana, the Carnatic, the North Deccan, Hyderabad, Mysore, Orissa, and the northern Circars.

— M. E. Grimaux exhibited to the French academy of sciences, at the *séance* of June 15, some unpublished printed documents showing the action taken by the commission on behalf of Lavoisier, at that time (1792–93) under arrest as a farmer-general. From one of these documents it appears, that, in consequence of the said action, the illustrious names of Laplace, Delambre, Borda, and others, were themselves removed from the commission on the 3d Nivôse of the second year of the republic (Dec. 26, 1793).

— A few years ago Dr. J. B. de Lacerda of Rio de Janeiro made extensive experiments upon antidotes for snake-bites, and finally settled upon the hypodermic injection of a solution of permanganate of potash as being the most efficacious. This remedy has also been used lately in Brazil against hydrophobia. One planter reports having used it over a year ago in two cases of persons bitten by rabid dogs. So far, these persons have shown no symptoms of hydrophobia. A colleague of Dr. Lacerda, however, treated by this method two patients who had been bitten by a rabid cat. One of them received the hypodermic injection fifteen minutes after having been bitten. As yet he shows no ill effects from the wound. The second, a child, was treated twelve hours after having been bitten, and died seven weeks later with all the symptoms of hydrophobia.

— The Brazilian government has directed Prof. Emil Goldi to investigate the disease of the coffee-plants. This disease was investigated by Capanema about four years ago, but no satisfactory conclusion was reached as to its character or the remedy for it. In the mean while it has been spreading.

— The sundry civil bill, as considered in the senate, restores the pay of the coast survey officials (changed by the house) to the figures now existing; it also appropriates $10,000 for salaries and expenses of the National board of health.

LETTERS TO THE EDITOR.

A most extraordinary structure.

ASIDE from the publicity which your theosophical correspondent has given the error which unfortunately crept into one of the plates in a recent contribution of mine to the Proceedings of the Zoölogical society of London (*Science*, vii. No. 177), the subject, I understand, has created no little comment in other quarters. Indeed, so thoroughly has it been discussed that I should have entirely disregarded this additional notice of it, had it not been that the attention thus called to it by this theosophist of the Smithsonian institution, placed it before your readers as 'a most extraordinary structure.' Surely it must be a structure most extraordinary to have excited any wonder in the eyes of a Smithsonian theosophist, when, in view of the fact that the published researches of Prof. Elliott Coues, another theosophist of the Smithsonian, called for no comment whatever. The succinct account of the researches I refer to, were published by Professor Coues in the New York *Nation* (Dec. 25, 1884), wherein this author in referring to his examination of ghosts, says "I myself, personally, have repeatedly by physical, chemical, and microscopical examination studied detached portions of them [ghosts], as hair, nails, or pieces of any substance which may envelop them more or less completely."

The fact of the matter is this, in both the figure and text I described the right humerus of a humming bird for the left. Mr. F. A. Lucas the osteologist of the Smithsonian discovered the error and courteously pointed it out for me. But Mr. Lucas did not write the letter in *Science* signed 'a theosophist,' and notwithstanding the fact that I am personally acquainted with the members of the staff of that institution, I know of no theosophist there who has

made sufficient progress in the study of the morphology of the Trochilidae to have detected the error in question. If there be such a person he has not up to the present time communicated the results of his studies to the world.

As soon as the error was clear to me, I immediately made a full series of corrected drawings, which, with additional notes upon the subject, are now in the hands of Dr. Sclater, the editor of the Proceedings of the Zoölogical society.

It pains me far more that the plates of such an elegant publication as the Proceedings of the Zoölogical society is, should be marred, even to the slightest degree, through any error of mine, than I regard how that error may reflect or affect myself. Fortunately, in the present instance it in no way alters the conclusions arrived at, and so far as I am aware there are but few, if any anatomists, who have not at one time or another been equally unfortunate. Even Huxley's famous 'Anatomy of vertebrates' seems to fulfil a useful end, notwithstanding the fact, that this eminent biologist contends on the 322d page of that work, in describing the stomach of a ruminant, and referring to the mucous membrane of the reticulum, says "it is raised up into a great number of folds, which cross one another at right angles, and, in this way, enclose a multitude of hexagonal-sided cells." Still this statement would make no one believe that few people living could render a better description of the digestive apparatus of a ruminant than Professor Huxley.

R. W. SHUFELDT.

Fort Wingate, N. Mex., July 3.

Barometer exposure.

The discussion concerning this subject has thus far had regard mainly to the use of the mercurial barometer and for meteorological purposes. Possibly light may be shed on the general subject by a few observations made in the field with an aneroid. From the nature of its construction it yields more quickly to rapid oscillations of atmospheric pressure. Moreover, field-work presents greater variety of conditions of exposure, and is consequently more suggestive of the controlling circumstance in any anomaly.

The following observations derived from experience, upon the western prairies of the Mississippi valley, may not be without value in this connection.

1. In gusty winds the index of the barometer oscillates very perceptibly to each gust. A variation of .01 of an inch has been observed.

2. In steady wind the barometer reads very differently, according as it is held to the windward or leeward of the body. In a wind which I cannot characterize more definitely than as a stiff breeze, I have noted in such relations a difference of .02 of an inch, the barometer being about three feet above the level surface. When desiring accurate readings in a strong wind, the mean between the windward and leeward readings should be taken, and, if the wind be gusty, the maximum reading in each case.

3. Upon flat-topped buttes I have found the barometer indicating considerably less pressure in the calm just back of the windward edge than in the wind at the edge.

Such buttes offer an inviting field for experimentation on this subject. They are often quite symmetrical, frequently have horizontal strata running through them to serve as convenient planes of reference, and are not infrequently isolated upon an extensive plane.

Attention to barometer exposure is evidently as important to hypsometry as to meteorology.

J. E. TODD.

Tabor college, Tabor, Io., July 3.

A bright meteor.

Last evening at fifteen minutes past eight o'clock a meteor of unusual size was observed. Its apparent size was, by rough estimate, six times that of Venus at its (Venus') brightest; and that, though it was quite near the moon, which was past its first quarter. Its altitude was about 30°, and azimuth perhaps S. 10° W., and its motion downward and eastward at about 50° from the horizon.

Its disappearance was with a slight scattering of fragments, but no explosion was heard.

S. H. BRACKETT.

St. Johnsbury, Vt., July 12.

Inoculation for the prevention of yellow-fever.

It is generally understood among educated people in Rio de Janeiro that all persons are not equally liable to attacks of yellow-fever. I believe I am safe in saying that but few native Brazilians die of it, the greatest number of deaths being among the following: newly arrived foreigners, and especially those who live in the poorer quarters of the city, or who lead dissolute lives, sailors, and persons of a lymphatic temperament. If there is any foundation for these popular theories, might it not be possible for an observant person to inoculate seven thousand individuals from the same or similar localities in Rio de Janeiro without running an average risk or fairly testing the system employed?

The efficacy of Dr. Freire's inoculation against yellow-fever can scarcely be considered as having been put to a fair test, therefore, until something is known of the persons inoculated, their nationality, time of residence in Rio de Janeiro, temperament, occupation, circumstances, and personal habits.

JOHN C. BRANNER.

Indiana university, Bloomington, Ind.

Bird-killing sparrows.

So much has been said of late for and against the English sparrow, that the following note may not be uninteresting as evidence.

Quite recently, upon the Capitol grounds, I observed a sparrow in the act of slowly killing a brown humming-bird. When discovered, it had seized the struggling victim in its talons, and was picking it vigorously about the head. Whenever disturbed, it caught the neck of its fluttering prey in its bill, and, after flying a few feet, alighted, and renewed its bloody work. At first I supposed the victim to be a sphinx moth; but, although every attempt to release the captive was futile, the identity of the humming-bird was unmistakable. Soon the first sparrow was joined by another, and then the scene of murder was carried into a copse beyond the reach of my observation.

To those who attribute the destruction of our American birds entirely to the demand for wings for ladies' hats, as well as to those who deny the quarrelsome habits of the sparrow, this piece of information may be of value.

C. D. WHITE.

National museum.

SCIENCE.—SUPPLEMENT.

FRIDAY, JULY 16, 1886.

ON THE PRESENT ASPECT OF CLASSICAL STUDY.[1]

THE chance that made me the first professor appointed to a chair in this university has made it my duty to represent the school of letters on this festal day, which has been chosen for the commemoration of the first completed decennium of our existence as an institution. The work of the university, so far as it can be expressed by lectures and by publications, by the number of teachers and of students, by the hours spent in laboratory and seminary, is all of record. Judged even by the census standard of facts and figures, it will be granted that what has been done here in the last ten years does not fall short of the standard which was set up in 1876. Less measurable, but not less certain, are the indications of our influence on the whole circle of university work in America; and, whatever we may have failed to do, we have assuredly not failed in rousing to greater vigilance, and stimulating to a more intense energy in other parts of the wide field; and, whether in the way of approval or in the way of protest, our example has made for life and growth and progress. This life and growth and progress have found a material expression in the erection and equipment of model laboratories for biology, chemistry, physics. Departments that are less tangible in their material and in their methods have little to show the visitor except a few books and a goodly number of men, — ardent students, who are busy with old problems and new, enriching themselves with the spoils of the past, laying up store for those who are to come after them, in the present neither envious nor afraid. As to this whole department of letters, then, — that department which has naturally fallen most under my own observation, — I can truly say that the healthy increase in the schools of language and literature is something that has transcended my most sanguine expectation. In numbers we outrank many of the minor German universities; and in the more abstruse and recondite studies, such as Assyrian and Sanscrit, we hold our own with some of the leading schools of Europe. As for our American sisters, it is not so easy to separate graduate work from undergraduate work in other American universities as it is here; and hence the comparison of numbers might not be fair, and might be misinterpreted; and instead of emphasizing too much our large number of graduate students, it may be better to say in regard to all the schools of the country in which higher work is done, that we count their success as our success, for we are all helpers one of another. And here I would take occasion to echo the wish, which I have often heard expressed of late, that the university departments in all American institutions of learning might be so organized that students could pass from one to the other in the prosecution of a line of study just as they do in Germany, much to the advantage of their breadth of vision, their freedom from local or personal influence. For my own part, I have always congratulated myself that I was brought under the influence of three distinct and markedly distinct philological schools, — Berlin, Göttingen, and Bonn, — and I have no doubt that, when the time comes, there will be a university exchange that will help us even more than the measure of it that we have thus far enjoyed. We then of the department of letters have our success to speak of on this day when a little 'self-esteem grounded on just and right' may be pardonable, if not, as Milton says, profitable. But it is a success that carries with it the gravest responsibilities. The ark we bear contains more sacred vessels than it held when we set out; and on an occasion like this it becomes us not only to exchange hearty congratulations that we have been helped thus far on our way, but to renew our hold with greater vigor, and to plant our feet more firmly, with a clearer view of the path to be trod and the burden to be borne.

To some, I do not know to how many, certainly to some of those whom I am addressing, the special line of work to which my own life has been devoted may seem to have had its day; and to plan for the future of Greek is to plan for an elaborate structure on the foundation of some table rock, destined at no distant time to fall and disappear on the restless current of modern life. A monument was erected some years since to the memory of the last old woman that spoke Cornish; and it would require no great stretch of imagination on the part of some of our friends to fancy that some youth may be present here today who shall live to see the cremation of the last

[1] Address delivered at the tenth anniversary of the Johns Hopkins university.

successor of Sir John Cheke on this side of the Atlantic ; of the last old woman, trousered or untrousered, that shall have discharged the office of a professor of Greek in an American university. People who have reached a certain age, and have become somewhat reflective and prophetic, generally console themselves with Hezekiah's words. But I cannot content myself with the thought that there will be peace and truth in my days. There has not been much of either of these commodities in my first half-century, and I do not expect the market to be glutted with them in my second. Surely there is no sign that there will be any peace about Greek, or truth about Greek, in any period that I can reasonably hope to reach. But the peace and the truth that may be denied me from without are vouchsafed me abundantly from within ; and while many of my fellow-workers are in woe for the silver shrines of Diana, and mourn for the abandonment of Greek, and sorrow that the trade in text-books languishes, I am serenely standing where I stood many, many years ago, when I published my first article on the 'Necessity of the classics,' a title not to be confounded with the 'Necessities of the classics,' about which one hears far too much. I live in the abiding assurance that what is inwrought in the structure of our history and our literature must survive so long as the history of our race and the history of our language shall survive. To disentwine the warp of the classics from the woof of our life is simply impossible. One mediaeval writer every one must know, and, measured by modern standards, Dante was not a classical scholar of the first rank. His perspective of antiquity was false, his estimate of the poets of the past was far from being just; and yet what is Dante if you loosen his hold on the classic time? I will not speak of Milton, steeped in classic lore: I will speak of Shakspeare. None but those who have read Shakspeare with the eye of the classical scholar know how much the understanding of Shakspeare is dependent on training in the classics; and more than once when I have hesitated as to whether it was pedantry or not to use a Greek word in my English discourse, I have turned to Shakspeare.

Is this the judgment of a man who can see only through his own narrow casement? Scarcely had I set down those words, when the following passage fell under my eye. It is to be found in the recent introductory lecture of the professor of poetry in the University of Oxford. "The thorough study of English literature, as such, — literature, I mean, as an art, indeed the finest of the fine arts, — is hopeless unless based on an equally thorough study of the literatures of Greece and Rome. When so based, adequate study will not be found exacting either of time or of labor. To know Shakspeare and Milton is the pleasant and crowning consummation of knowing Homer and Aeschylus, Catullus and Virgil; and upon no other terms can we obtain it." [1]

To be sure, we have promise of mountains and marvels if we break with the past. What satisfied us in our boyhood no longer suits the fastidious taste of the present; and the Phoebus Apollo of our youth, clad as to his dazzling shoulders with a classic cloud, is shown up as nothing better than a padded dandy. Our adored Thackeray is no longer faultlessly attired in a garb of perfect English : he is simply a stylistic old beau. The plots in which we once took delight are nothing but vulgar tricks, and the lifting of a teakettle lid and the setting down of the same are intrigue enough for the conduct of a two-year-long novel. All this new literature has nothing to do with the classics. Far from it. And yet I am not at all shaken by the self-satisfied edicts of those who rule so large a portion of the reading world ; and I maintain with unwavering confidence that all healthy literature must be kept in communion, direct or indirect, with the highest exemplars of our Indo-European stock; and if any thing could prove the necessity of a return to healthy human nature, with its compassed form, its fair red and white, it would be the utter wearisomeness of so much recent fine writing, in which there is no blood, no sap, nothing but division and subdivision of nerve-tissue. 'A pagan suckled in a creed outworn' is a joy and delight in comparison with the languid, invertebrate children of the great goddess Anaemia.

I have watched with much interest the development of the study of artistic composition in English during the last few years. Indeed, it would have been necessary to stop one's ears to keep out the shrilling cicada-sound of 'art for art's sake,' and all the theoretical buzz of aesthetic criticism. The interest has not been unmingled with amusement, because the apostles of progress are preaching very old doctrine, — a doctrine which I shall be glad to re-enforce, so far as I can, before I acquit myself of this function. Art for art's sake involves the very hardest, the very driest study, the very kind of study for which we philologians and grammarians are contemned. The accomplished master in the art of dipping, who delighted the world a few weeks since by his 'Letters to dead authors,' made his swallow-wing strong on the Elysian fields of the classics; and those who should hold him up as an example of the kind of classical scholar we ought to have, little know to

[1] F. T. Palgrave, 'Province and study of poetry.'

what severe studies is due that easy grace. It is so cheap to talk about gerund-grinding and root-grubbing, as if gerund-grinding did not lead to the music of the spheres, and root-grubbing to the discovery of the magic moly that guards against the spells of Circe, of 'euphrasy and rue,' that purge 'the visual nerve.' He who neglects the elements lacks the first conditions of the artistic life. In the old times great artists did not disdain to prepare their own varnishes; and the old paintings stand fresh to this day, while many of their modern rivals, scarce a generation old, are falling into decay beyond the hope of recognition. The fair dream was embodied in machine pigments, and the machine pigments flake off, and with them the fair dream vanishes. If grammatical research is pressed with regard to truth, to that which is, then the gerund-grinding, as the color-grinding, not only has its warrant in itself as a useful exercise, but it is sure to be available for higher purposes; and if it is not given to every one to make use of grammatical results for artistic ends, still no organic fact is without its value, none will fail of its appropriate place in the completed system of art as of science. To me, as an ardent lover of literature, as one who was led through literature to grammar and not through grammar to literature, the fairest results of a long life of study have been the visions of that cosmic beauty which reveals itself when the infinitely little fills up the wavering outline, and the features stand out pure and perfect against the sky of God's truth. Now, for the study of literature as an art, we have every thing to learn from the old critics; and what our own Sylvester, our own Lanier, have re-discovered as to the science of verse, is a chapter from antique rhetoric. Mr. Lowell has recently pointed out the great secret of Gray's abiding popularity. That consummate master did not disdain the close analysis of the sensuous effect of sound; and the melody of Coleridge is due in a measure to a conscious though fitful study in the same line. Of late an author, whose charm of style was first appreciated in this country, has written an essay in which he applies phonetic analysis to the works of our great prose writers, and strikes the dominant chord of what seems unconscious music. The essay might have been written in the beginning of the first century as well as the end of the nineteenth, and have been signed Dionysius of Halicarnassus as well as Robert Louis Stevenson.

Whether, then, it be for the historical unity of the race, whether it be for the human sanity of classical literature, whether it be for the influence on form either as example or precept, there is no danger that the ancient classics will be displaced from the list of studies necessary for the highest and truest culture. Nor do I think that the so-called hard and dry and minute research in this and cognate provinces of study will ever be abandoned in favor of a mere bellettristic phrase-mongery about half-understood beauties. What is hard, what is dry, what is minute, depends very much on the spirit in which it is approached by the student.

Some years since, I attended a lecture by a great master. The theme was the vanishing of weak vowels in Latin. Candor compels me to state, that, although I pride myself on being interested in the most uninteresting things, I should have chosen another subject for a specimen-lecture. Candor compels me to state also that I very much question whether the illustrious teacher would accept all his own teachings to-day, such progress do grammarians make in devouring themselves as well as one another. I was much struck with the tone in which he announced his subject. It was the tone of a man who had seen the elements melt with fervent heat, and the weak vowels vanish at the sound of the last trump. The tone, indeed, seemed entirely too pathetic for the occasion; but as he went on and marshalled the facts, and set in order the long lines that connected the disappearance of the vowel with the downfall of a nationality, and great linguistic, great moral, great historical laws marched in stately procession before the vision of the student, the airy vowels that had flitted into the nowhere seemed to be the lost soul of Roman life, and the Latin language, Roman literature, and Roman history were clothed with a new meaning. And so we of the language departments do not intend to be disturbed in our work by criticism on the arid details of our courses; nor, on the other hand, are we unmindful of the larger and more popular aspects of the wide field of culture which we occupy.

There is no form of art, no phase of philosophy, of ethics, no development of physical science, that is alien to the student of language; and the student of physical science, in his turn, needs the human interest of our study to save his life from an austere and merciless quest of fact and principle in a domain where man enters only as a factor like any other factor. But first and last, the scientific standard must be upheld for the university man, be he a student of letters, be he a physicist; and that standard is the absolute truth, the ultimate truth. 'Nothing imperfect is the measure of any thing,' says the prince of idealists.[1]

B. L. GILDERSLEEVE.

[1] ἀτελὲς γὰρ οὐδὲν οὐδενὸς μέτρον (Plato, Republic VI., 504 C).

MR. JAMES SULLY ON THE PRECOCITY OF GENIUS.

WHENEVER Mr. Sully turns his attention to a problem in psychology or anthropology, he is sure to give it a lively, interesting treatment, and to accompany it with a wealth of illustration. His paper on 'Genius and precocity' in the June number of the *Nineteenth century* is no exception to this: and it has the additional attraction of dealing with a question quite within the popular comprehension.

Mr. Sully says that the idea that genius reveals itself early in life is repugnant to common sense. It seems more fitting that genius should be the result of development and close application. To test the question, two methods may be pursued. First, it may be asked what proportion of those who have shown marked precocity have afterwards redeemed the promise of their youth? and, secondly, what number of those who have unquestionably obtained a place among the great were previously distinguished by precocity? The former line of inquiry is evidently of great complexity, and Mr. Sully therefore confines himself to the second question, and also examines only instances in modern times, where the evidence is reasonably full and accurate, and in the departments of art and literature. The field of practical affairs, including statesmen, soldiers, and ecclesiastics, is not entered upon. Mr. Sully's precise question therefore is, in what proportion of cases, in the realms of art and literature in modern times, has recognized intellectual eminence been preceded by youthful distinction and superiority to others. He distinguishes seven groups: 1°, musicians; 2°, painters; 3°, poets; 4°, novelists; 5°, scholars, including historians and critics; 6°, men of science; 7°, philosophers. Any manifestations in childhood or youth of an exceptional aptitude and bent, corresponding to the special direction of the later development of genius, are taken as indications of precocity. Childhood and youth end, in Mr. Sully's data, at the twentieth year of life.

In his first group, the musicians, Mr. Sully cites as precocious the well-known cases of Mozart, Beethoven, Mendelssohn, and Schubert; and the not so familiar cases of Meyerbeer, Hillier, Spohr, Méhul (who was an organist at ten), Schumann, Cherubini, Auber, Weber, David, Lotti, and Purcell. Rubinstein played finely at ten, Liszt at twelve. Of 40 musicians enumerated, 38 showed a decided bent before twenty. Of these 38, 29 are known to have had the gift as children, and there is reason to believe that others betrayed it by the age of twelve. In only two cases — the rather surprising ones of Rossini and Wagner — is there a lack of early manifestation of musical ability.

The second group includes painters and sculptors, and among the precocious are to be found Mantegna, Andrea del Sarto, Raffael, Tiziano, Michael Angelo, Murillo, Holbein, Ruysdael, Cornelius, Vernet, and Ary Scheffer. Of the great sculptors, Canova carved a lion at twelve, and Thorwaldsen began work at eleven. Of the 58 representatives of this group, 42 showed decided talent before fifteen, and 47 before twenty. In none of the instances was artistic fame acquired after the age of forty.

Among the poets, comprising the third group, Tasso wrote 'Rinaldo' at seventeen; Calderon composed very early; Goethe wrote dialogues at six; Alfred de Musset had written poems before fourteen. Beaumont, Cowley, Pope, Byron, and Coleridge were all precocious. Elizabeth Barrett Browning wrote poetry at eight, and Mrs. Hemans published her first volume at fourteen. Of 52 poets, 39 were distinctly precocious.

The fourth group, novelists, tells a similar story. Scott, Dickens, Lytton, Balzac, Hoffman, Charlotte Brontë, and Miss Burney are familiar instances of precocity. Of 28 novelists, 21 gave evidence of great imaginative power before twenty.

Of the fifth group, scholars, historians, and critics, Grotius, Porson, Niebuhr, Macaulay, and Thirlwall are well-known instances. Of 36 representative names, 30 showed preternatural ability in childhood or early youth.

The sixth group, men of science, has among the affirmative instances Galileo, Tycho Brahe, Newton, Thomas Young, Clerk-Maxwell, Sir William Rowan Hamilton, Cuvier, Haller, and Laplace. Of 36 cases examined, 27 gave evidence of a decided bent to science before twenty; of the remainder, 5 took to science after twenty, and 4 are doubtful.

The seventh and last group, philosophers, shows as precocious Berkeley, — who, as his commonplace-book shows, hit upon his new principle of idealism when a youth of eighteen at college, and who wrote his 'New theory of vision' at twenty-four, — Hume, Leibnitz, Schelling, and John Stuart Mill. Of 37 eminent representatives of this group, 25 showed marked philosophical inquisitiveness before twenty.

The summation of the seven groups is remarkable; for it shows that out of 287 names chosen, 231, or 80.48 per cent, were precocious. As a rule, the productive period also begins early. In a total of 263 cases, we find 105, or 40 per cent, produced works before the age of twenty; and 211, or 80 per cent, before the age of thirty. Moreover, a large majority of great men attain

success in early manhood. Out of 258 cases examined, 101, or nearly 40 per cent, attained success before the age of twenty-five; and 155, or 60 per cent, attained it before thirty-five.

In viewing the statistics as a whole, we find the following results: —

1°. The proportions of the various groups showing distinct promise before twenty are, musicians, $\frac{19}{20}$; artists, $\frac{8}{9}$; scholars, $\frac{5}{6}$; poets, novelists, and men of science, each, $\frac{3}{4}$; philosophers, $\frac{2}{3}$.

2°. Taking the age of thirty as the limit, we find the following proportions of the various groups showing early production: musicians, all; artists, $\frac{41}{42}$; poets, $\frac{11}{12}$; scientists, $\frac{4}{5}$; scholars, $\frac{5}{7}$; philosophers, $\frac{5}{9}$; novelists, $\frac{9}{16}$.

This order in respect to precocity answers roughly to the degree of abstractness of the faculty employed. The musicians and artists, representing the sensuous faculty, are found at one extreme; and the philosophers, representing the highest degree of abstraction, at the other. Between them are the poets and novelists, the men of imagination.

Genius, Mr. Sully concludes, is essentially natural. A truly great man is born such; that is, he is created with a strong and overmastering impulse to a definite form of origination: so he usually evidences it early. But actual production implies also opportunity, physical vigor, and leisure; hence circumstances become of importance as aiding or delaying achievement. Allowing for all this, there are some cases which are explicable only as illustrations of a process of slow development. Sometimes, as was the case with Dante, Milton, and Cervantes, the postponement was volitional and not compulsory.

Genius is precocious, then, in the sense that it manifests itself early. But does it attain the summit of its development quickly, or does it go on improving as long as, or longer than, ordinary intelligence? This is a separate question, and one to which Mr. Francis Galton ('Hereditary genius,' p. 44) gives an affirmative answer. We hope that Mr. Sully himself will before long throw some light on this question too.

EVERY-DAY LIFE OF THE WOMEN OF INDIA.

THE Society of arts lately listened to a paper by Capt. Richard Carnac Temple on the life and habits of the women of India. The author's qualifications for writing such a work would seem to be excellent, as he has lived long in the country, and has an extensive acquaintance with its popular literature. He does not treat of all classes of Indian women, but chiefly of the higher-caste Hindus, who, however, as he tells us, practically set the example for all the rest.

An Indian woman's life, he says, in its ordinary course, is divided into two clearly defined parts, which are quite distinct, though separated from each other only by the fateful day on which she first goes to take up her abode within her father-in-law's family. Note that it is not called in the Indian languages her husband's family, for that, under the Indian family system, it can seldom be in the case of a bride. Childhood, rather than girlhood, is the heyday of the Indian woman. Free to play as she pleases, with plenty of companions (for children can hardly ever be wanting in a family where all live together, from oldest to youngest); free to run in and out of the houses of friends; never bothered to learn any thing, except what she can pick up from the women about her; never worried with caste restrictions; never asked to do more in the way of labor than to help in the housework; petted by her parents; spoiled by her aunts and uncles, and beloved by her brothers, — an Indian girl-child is indeed happy, as children count happiness. And then suddenly the curtain falls. At about ten years of age — earlier in some parts, and later in others — our spoilt child is old enough to work in earnest, and so she is packed off, sorely against her will, to join her husband's family, entering it not as our brides enter their future homes, at the head of the female community, but at the bottom.

At this stage it is necessary to consider two matters, so far as they affect an Indian bride; viz., the practice of infant marriage, and what is known as the joint-family. It need hardly be stated that the so-called 'marriage' of infants is practised among all classes in every part of India, though of course there are many exceptions to the rule. The term 'marriage,' as applied to this ceremony by us, is, however, rather misleading. It is in reality an irrevocable betrothal, — a bargain, not between the infants who are 'married,' but between those who control them, being often nothing else than a purely commercial contract. It arises out of the theory that a woman is for life under tutelage, and her 'marriage' is therefore merely a transfer of the right over her to another party, — a transfer naturally very frequently made in return for a pecuniary consideration. After this marriage, or betrothal, the girl usually remains with her parents, in trust for those to whom she is to be transferred, until the home-coming, or going to her husband's house, which may be looked upon as the real marriage, as we use the word. Until the second ceremony takes place, the child-wife is still a child to all intents and purposes, and treated

as such, and it is only after it that she in any sense enters on the duties of female life. The family she joins is exactly like that she has left, only it is that of another; to her a vast difference, and one which she never forgets—indeed, it is not unfrequently made painfully apparent to her at every step. What may be called the regulation Indian joint-family is one composed of the paterfamilias, all his sons and brothers, and various extraneous relatives, such as nephews, cousins, and wife's kindred, for the male part; and all their wives, in addition to his own wife and daughters, together with a sprinkling of the family widows, for the female part. In this patriarchy there are grades upon grades, both male and female, dependent chiefly upon age and distance by blood from the head of the family; and as everybody is married in India as soon as the time for it comes, the chances are that the last-made bride is, in the nature of things, in the very lowest place.

In the average Indian family the strictest domestic economy is the rule of life, and the household work is done by the women of the household, not, as with us, by paid servants. Servants there are, of course, in all Indian families, but they are, as a rule, on a totally different footing from that of the European domestic, being for the most part independent persons with a *clientelle*, for whom they perform certain customary services for a customary wage. The distribution of the daily work, down to the most menial kind, lies with the materfamilias, who may be best described as the oldest married woman in the family proper, for widows can have no authority. The cooking, as the work of honor, she keeps to herself, but the house-cleaning, the washing, the care of the children, the drawing of the water, the making of the beds, and so on, is done by the less dignified members of the household, as she directs; and whatever is most menial, most disagreeable, and the hardest work, is thrust upon the bride.

Not only is our bride thus turned into a drudge, often unmercifully overworked, but from the day she gives up her childhood to the day of her death — it may be for sixty years — she is secluded, and sees nothing of the world outside the walls of the family enclosure. She is also, by custom, isolated as far as practicable from all the male members of that little inner world to which she is confined. Free intercourse, even with her own husband, is not permitted her while yet her youthful capabilities for joyousness exist.

Every person belonging to the European races well knows how much common meals tend to social sympathy; how powerful a factor they are in promoting pleasurable family existence, and in educating the young to good manners. There is nothing of this sort in Indian upper-class society. There the men and women dine strictly apart, the women greatly on the leavings of the men, and that, too, in messes of degree, very like those in a royal naval ship. Paterfamilias dines by himself; then the other men in groups, according to standing, waited on by the women under fixed rules; and lastly the women, when the men have done, our poor young bride coming last of all, obliged often to be content, it need hardly be said, with the roughest of fare.

Such, then, is one of those customs which go to make an Indian woman's existence less happy than it might be. Let us notice another, this time as to family intercourse. No imported woman may have any relations with those males who are her seniors. Every bride is such an imported woman, and all the household which she enters who are the seniors of her husband are her seniors. This at first generally includes nearly the whole family, and must necessarily for a long while include the major part of it. In all her life she never speaks to her husband's father, uncles, or elder brothers, though dwelling under the same roof, or, to speak more correctly, within the same enclosure, for an Indian house is what we should call a courtyard surrounded by sets of apartments. On the other hand, paterfamilias has not only never spoken to, but technically never even seen, any of the younger women of his varied household, except those born within it, though they all dwell under his protection and at his expense.

There is another custom regarding which it is useless to pretend that it does not lead to endless misery and family squabbling, — the absolute subjugation of the women to the materfamilias. The mother-in-law is indeed an awful personage in the eyes of her sons' wives, one against whose will and caprice it is hopeless to rebel. One cannot describe her power better than by noticing a daily ceremony which symbolizes it. It amounts to wishing 'good-morning,' is called in Upper India *máthá teknú*, and consists of bowing down to the ground and touching it with the forehead. All the women, except her own daughters, perform it daily to the materfamilias when they first see her, and a bride must do it practically to everybody.

An Indian woman's happiness in life immensely depends on her becoming the mother of a son. This at once raises her in the family estimation, which is all in all to her; insures her against the greatest bitterness of widowhood, in case that befall her; and procures her domestic authority should she survive the mature years with her husband still living. Materfamilias is a veritable queen in her own little world, often coercing her

husband, commanding her sons, and ruling the rest as she pleases. The remarks just made apply, as above said, to the mothers of sons only.

Again, take the case of the widow from infancy: shorn of much that women value in the world, dressed in coarse clothing, deprived of her ornaments, compelled to fast till health breaks down, made to subsist on the coarsest of food, kept out of what amusements come in the way of the rest of the household, forced into being the unpaid drudge of the family, held to be the legitimate butt of the ill nature of all, considered fit only to amuse the children, openly called and taught to think herself a creature of ill omen, — this being the cause of all the rest of her sorrows, — superstition has indeed nowhere else shown more clearly its power to pervert the reason of man. How much the women dread widowhood is exhibited to the full in the fact that to call a woman a widow is to offer her a dire insult, and from her earliest childhood a girl is taught to pray that she may die while yet the red spot, which is the sign of the married state, remains on her forehead.

It must not be thought, however, that an Indian woman's life is necessarily all unhappiness. Human nature in her case is as capable of adapting itself to circumstances as elsewhere; and since the ultimate gauge of permanent individual happiness is suitability of temperament to immediate surroundings, many a woman in India must be so constituted as to be quite content with the life she is called upon to lead, and in fact to enjoy it. When a girl is naturally sedate, yielding, and good-natured, of blunt susceptibilities, limited aspirations, and strong religious emotions, she will give in to her mother-in-law, avoid quarrelling without effort, follow the course of life laid down for her without demur, thoroughly believe it to be the only desirable life to lead, find the innumerable restrictions imposed upon her not unwelcome, and become contented with her contracted sphere, and, if those about her happen to be kind, be quite as happy as any girl in the world. But the potentialities for misery involved in her surroundings are enormous, and, where such is the case, to argue that misery is not the frequent result would be to argue against human nature.

Such is the life of Indian women as described by Captain Temple; and there seems to be little to deprive it of its gloom, except the frequent holidays and the feasts that attend them. He tells us, however, that the women themselves are the strongest supporters of the social system which dooms them to such a life; and this he attributes in part to religious sentiment, and in part to the well-known fact, that women, all the world over, are the strongest advocates of social rules and ceremonies.

As to the best methods of improving the women's lot, the author of the paper spoke somewhat hesitatingly. He thinks that something may be accomplished by the native monotheistic church known as the Brahmo Somaj; and he alluded favorably to the efforts of certain missions of European origin, and to the society organized under the auspices of Lady Dufferin for furnishing medical aid to women. He took occasion to reprobate the practice of child-marriage, and expressed the hope that it may be disallowed by law. There is now pending in the Indian courts a case in which the question of the legality of such marriage has been raised; and if the decision should be against its legality, an important reform would thus be wrought. It is evident, however, that the main cause of the evils that Captain Temple has pointed out, is the system of caste; and so long as this system prevails, there can be no satisfactory improvement in the life of Indian women.

MINCHIN'S STATICS.

IN the third edition of his valuable treatise on statics, of which the second volume has recently appeared, Professor Minchin has enlarged the work by about two-thirds of its previous amount. The new matter is almost all contained in the second volume, and consists largely in an exposition of the theory of screws, a chapter on astatic equilibrium, and very large additions to the chapters on the theory of attraction, electrostatics, and the theory of strains and stresses. There are also other important additions, notably in the chapter on virtual work. The theory of attraction is far more extensively treated than in the second edition, the space devoted to it being 122 pages as against 37. Spherical harmonics are introduced in the present edition, and it may be mentioned that the author proposes and employs the term 'Laplacian' to denote a Laplace's coefficient.

In the preface to the second volume the author lays stress on the fact that he has, in the chapter on attractions, explicitly adopted the C. G. S. system, in order to constantly fix the mind of the student on the concrete realities for which his symbols stand. This is undoubtedly most desirable; but we cannot help suspecting that the importance of this and similar points of discipline, as objects of a scientific treatise, are overestimated by Professor Minchin and other English writers. It is

A treatise on statics. By GEORGE M. MINCHIN. Vol. ii. Oxford, *Clarendon pr.*, 1886. 8°.

certainly going to great extremes to say, that, "without this definiteness of idea, no knowledge of the slightest value can exist." However, no harm would probably be done by this excess of what is certainly in itself a merit, were it not that the constant endeavor to insure the student's good grip of his tools throws into the background all considerations of elegance, and often interferes with unity of treatment and a harmonious development of the subject. In these features, Professor Minchin's work leaves much to be desired; but its comprehensiveness, the fulness and clearness of its explanations, and its richness in examples, make it extremely valuable both as a text-book and as a work of reference. Its usefulness in the latter capacity has been increased by the addition of an alphabetical index.

ROYCE'S CALIFORNIA.

THIS work is the seventh in the series of 'American commonwealths,' now in course of publication under the editorship of Mr. Horace E. Scudder. The author, who is already known to the readers of *Science*, is a native of California; and his work, as he himself tells us, has been a labor of love. It deals but slightly with the early history of the country, when it was under Mexican rule, but takes up the subject at the time when our government was seeking to gain possession. This was in 1846; and the work closes with the final establishment of order in the state in 1856, thus covering a period of ten years.

The work is properly divisible into two parts, the first treating of the conquest of the country by the United States, and the second of the politics of the state itself after the war was over. The reviewer is obliged to say that the book has grave faults of style and treatment, particularly in the earlier part. The style is verbose, and the chapters that treat of the conquest are carried to such a length that few persons will have the patience to read them through.

Mr. Royce, like most other people, regards the Mexican war and its accessories as little creditable to the American nation; though, of course, he recognizes the good results that have actually flowed from it. He thinks, too, that we might have got California by peaceful means, or at least with the consent of its inhabitants, if we had pursued the right course; and that we failed in this, he thinks is due to the misconduct of some of our military and naval officers. He is specially severe on Captain Frémont, whom he regards as mainly responsible for the fighting that occurred in California, and consequently for the animosities and race-hatreds that it engendered.

In the fourth and fifth chapters, the author treats of the 'struggle for order' between the law-abiding citizens on the one hand, and the criminal elements on the other. Congress having neglected to provide a permanent territorial government for California, the people met of their own motion in the autumn of 1849, and organized as a state, which was soon after admitted into the union. When this had been done, however, the struggle with the lawless elements of society was only just begun; and it took seven years longer to reduce the whole state to an orderly condition. The causes of the long continuance of social disorder were, in Mr. Royce's opinion, two, — the general sense of irresponsibility due to the irruption of a crowd of fortune-hunters; and the animosity of the American settlers toward the Mexican inhabitants on the one hand, and foreigners on the other; to which we would add the political incapacity of the Mexican inhabitants themselves.

In his last chapter the author treats briefly of the land question in California. When our government took possession of the country, there were many tracts of land the ownership of which was doubtful, and this would have caused much difficulty in any case. But our people saw fit to treat the ownership of all tracts as doubtful, and compelled the landholders to prove their titles in the courts as a prerequisite to having them recognized. The courts, however, sustained the vested rights of the proprietors; and Mr. Royce thinks that the whole history of California "has illustrated the enormous vitality of formally lawful ownership in land."

American commonwealths. California. By JOSIAH ROYCE. Boston, *Houghton, Mifflin & Co.*, 1886. 16°.

ACCORDING to official statistics, it appears, says the Journal of the Society of arts, that on the 31st of December, 1881, 382,131 persons were engaged in manufactories in Italy. Of these, 219,844 were spinners (69,447 being children); 77,779, weavers (13,628 children); and in printing 15,499 (618 children) were employed. In 1876 there were 229,538 weavers who worked at their own homes, chiefly in Sicily, Sardinia, Calabria, Apulia, and the Marche of Ancona.

— *Nature* states that during the present summer a university will be opened at Tomsk, in Siberia, the first of its kind in this part of the Russian empire. At first it will consist of two faculties, — an historical-philological one and a physical-mathematic. It already possesses a library with fifty thousand books, a very valuable paleontological collection, presented by Duke Nicolaus of Leuchtenberg.